



(12) **EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:
26.04.2017 Bulletin 2017/17

(51) Int Cl.:
H01L 29/78 ^(2006.01) **H01L 29/06** ^(2006.01)
H01L 29/08 ^(2006.01) **H01L 21/336** ^(2006.01)
H01L 29/10 ^(2006.01) **H01L 21/265** ^(2006.01)

(43) Date of publication A2:
17.07.2013 Bulletin 2013/29

(21) Application number: **12168147.2**

(22) Date of filing: **15.05.2012**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **11.01.2012 TW 101101042**

(71) Applicant: **Vanguard International Semiconductor Corporation**
30077 Hsinchu (TW)

(72) Inventors:
• **Lee, Tsung-Hsiung**
Taoyuan City 330 (TW)
• **Tu, Shang-Hui**
Tainan 702 (TW)

(74) Representative: **Habermann, Hruschka & Schnabel**
Montgelasstrasse 2
81679 Munich (DE)

(54) **Field-effect transistor and manufacturing method thereof**

(57) The field-effect transistor (20;20';20";20''') includes a plurality of first epitaxial layers (204), a second epitaxial layer (206) and a gate structure (228;230). The plurality of first epitaxial layers (204) is stacked on a substrate (200) and has a first conductivity type. Each first epitaxial layer (204) includes at least one first doping region (204a) and at least one second doping (204b) region adjacent thereto. The first doping region (204a) has a second conductivity and the second doping region (204b) has the first conductivity type. The second epitaxial layer

(206) is disposed on the plurality of first epitaxial layers (204), having the first conductivity type. The second epitaxial layer (206) has a trench (206a) therein and a third doping region (212;212';212";212''') having the second conductivity type is adjacent to a sidewall of the trench (206a). The gate structure (228;230) is disposed on the second epitaxial layer (206) above the second doping region (204b). A method of fabricating the field-effect transistor (20;20';20";20''') is also disclosed.

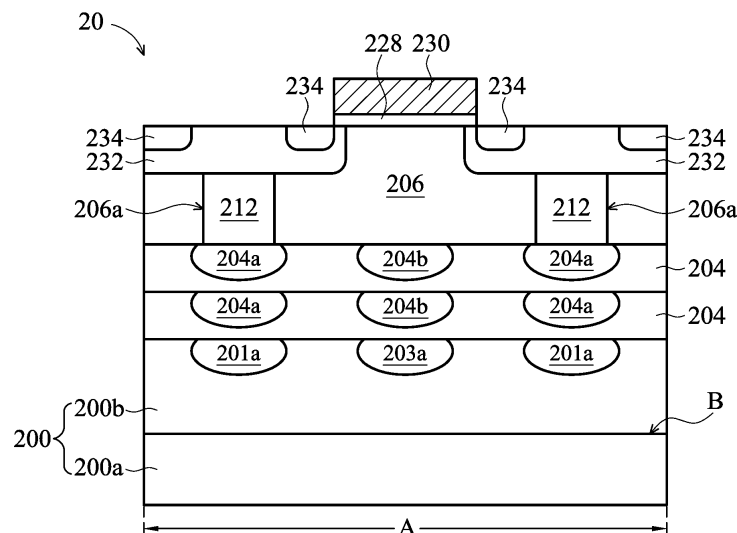


FIG. 2G



EUROPEAN SEARCH REPORT

Application Number
EP 12 16 8147

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2006/043481 A1 (YAMASHITA ATSUKO [JP] ET AL) 2 March 2006 (2006-03-02) * paragraphs [0066] - [0070], [0073], [0088] - [0090]; figures 4,6,7,13-16 *	1-17	INV. H01L29/78 H01L29/06 H01L29/08 H01L21/336
A	US 2011/233656 A1 (OHTA HIROSHI [JP] ET AL) 29 September 2011 (2011-09-29) * paragraphs [0118] - [0131]; figure 19A *	1-17	ADD. H01L29/10 H01L21/265
A	WO 01/95398 A1 (GEN SEMICONDUCTOR INC [US]) 13 December 2001 (2001-12-13) * sentences 0008,0024; figures 4-6 *	8,9,16	
A	US 6 376 878 B1 (KOCON CHRISTOPHER B [US]) 23 April 2002 (2002-04-23) * column 3, lines 59 - 67 - column 4, lines 1-11; figures 14-16 *	8,9,17	
			TECHNICAL FIELDS SEARCHED (IPC)
			H01L
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 17 March 2017	Examiner Diaz Alvarez, C
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 12 16 8147

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

17-03-2017

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2006043481 A1	02-03-2006	JP 4851694 B2	11-01-2012
		JP 2006066421 A	09-03-2006
		US 2006043481 A1	02-03-2006
US 2011233656 A1	29-09-2011	JP 2011204796 A	13-10-2011
		US 2011233656 A1	29-09-2011
WO 0195398 A1	13-12-2001	AU 7510501 A	17-12-2001
		CN 1443372 A	17-09-2003
		EP 1287562 A1	05-03-2003
		JP 5144869 B2	13-02-2013
		JP 2004509452 A	25-03-2004
		KR 20030019408 A	06-03-2003
		TW 523926 B	11-03-2003
		US 2002014658 A1	07-02-2002
		US 2004070044 A1	15-04-2004
		US 2006249788 A1	09-11-2006
		WO 0195398 A1	13-12-2001
US 6376878 B1	23-04-2002	AU 3464801 A	20-08-2001
		EP 1256133 A2	13-11-2002
		JP 2003523089 A	29-07-2003
		JP 2012138600 A	19-07-2012
		US 6376878 B1	23-04-2002
		WO 0159848 A2	16-08-2001